

NATURAL HYBRIDS OF LADY'S SLIPPERS (CYPRIPEDIUM) IN MANITOBA

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A small yellow lady's slipper, *Cypripedium Calceolus* L. var. *parviflorum* (Sal.) Fern., occurs frequently in low meadows in southern Manitoba, Canada, while *C. candidum* Muhl., a tiny white lady's slipper, is more restricted and has been reported from only three Manitoba locations, Woodlands, Brandon and Aweme (Scoggan, 1947). In 1954 an investigation of cream colored lady's slippers found in association with *C. Calceolus* var. *parviflorum* and *C. candidum*, was conducted by the authors. From 1954 to 1964 annual surveys of three areas of 5 to 20 acres between Brandon and Aweme revealed similar lady's slippers but profuse flowering was recorded only in 1954. These hybrids were similar to those described by Fuller (1932) and Curtis (1932) as *C. × Andrewsii* Fuller.

Seedlings of *C. Calceolus* var. *parviflorum* are influenced greatly by local environmental conditions (Curtis, 1943). He reported that plants grown from seed may bloom in 9 years under favorable conditions but may take 15 years to bloom and *C. candidum* probably requires 12 or more years to bloom. Plants of both species are long-lived.

Lady's slippers in nature are pollinated by bees of the genus *Andrena* (Darwin 1890). The sticky pollen does not permit wind pollination and the location of anthers and stigma precludes self pollination. Hybrid lady's slippers can therefore occur naturally if suitable pollinators are present and cross-compatible species occur in the same area and have overlapping periods of bloom. Fuller (1932) states that it is very likely wherever *C. candidum* and *C. Calceolus* var. *parviflorum* grow in the same vicinity, hybrids will be found.

Stebbins (1957) describes a method of indexing plant characteristics to identify hybrid populations. Each trait

is indexed on a scale of from 1 to 5 although the range may be either reduced or extended. Plants with the lowest total for indexed characteristics are considered of the one parental type and those with the highest total for indexed characteristics are of the other parental type.

This paper reports characteristics of natural hybrids of *C. candidum* × *C. Calceolus* var. *parviflorum* in Manitoba and presents an hypothesis to explain the origin of the hybrids.

In June 1954, 55 specimens of *Cypripedium* were collected from a low lying meadow in section 11 township 10 range 18 west of the principal meridian southeast of Brandon, Manitoba. Measurements or descriptions of 10 characteristics, i.e. height, leaf number, length and width of the largest leaf, length and width of lateral petals, color and length of lip, and length and width of the upper sepal, were recorded. Plant characteristics were indexed according to the method described by Stebbins (1957) to identify hybrid populations. The smallest measurement, fewest number and least intensity of color was assigned the lowest index number. The specimen plants with the lowest total for indexed characteristics are most similar to the *C. candidum* parent and those with the highest totals are most similar to the *C. Calceolus* var. *parviflorum* parent.

In 1963, controlled crosses were made between *C. candidum* and *C. Calceolus* var. *parviflorum* to establish whether the purported parents were cross-compatible and could give rise to hybrids.

Viable hybrid seed was readily produced by hand pollination of *C. candidum* and *C. Calceolus* var. *parviflorum* thus indicating that they are cross-compatible and could have given rise to hybrids. Native *C. candidum* commences bloom two weeks earlier than *C. Calceolus* var. *parviflorum* at Brandon, Manitoba, hence, their bloom periods seldom coincide and rarely overlap for more than a few days. This is at variance with Fuller (1932) who stated that they bloom at the same time. The bloom period of *C. × Andrewsii* commences 10 days after *C. candidum*, thus it overlaps the bloom period of *C. Calceolus* var. *parviflorum* to a greater

Table 1. Plant measurements (cm) of the two parental species, *C. candidum* and *C. Calceolus* var. *parviflorum*.

Plant Characteristic	<i>C. candidum</i>		<i>C. Calceolus</i> var. <i>parviflorum</i>	
	1.	2.	1.	2.
Plant height	15 - 40	14 - 22	20 - 70	17.2 - 32.5
Leaf-length	-	9.5 - 12.5	11 - 20	12 - 15.5
-width	1 - 4	2.0 - 3.5	4 - 12	3.8 - 6.7
Sepal-length	2 - 3	2.1 - 2.8	4 - 7	3.8 - 4.8
-color	greenish spotted with purple	green with purple streaks	greenish yellow streaked purple	greenish yellow streaked purple
Petal-length	2.5 - 3.5	2.2 - 3.2	5 - 9	4.8 - 6.1
-color	greenish spotted with purple	green with purple streaks		
Lip-length	1.8 - 2.5	1.6 - 2.0	3 - 5	2.9 - 3.5
-color	waxy white, purple veined	white, purple veins	golden yellow	yellow

1. Data taken from Scoggan (1957) and Fernald (1950).
2. Brandon data.

extent than that of *C. candidum*. Bloom appears to be influenced greatly by local environmental conditions as indicated by Curtis (1943). Only in 1954 was profuse flowering observed. In 1964 late spring frosts on May 30 (25°F), May 21 (27°F) and June 1 (26°F) destroyed flower buds and bloom was observed in only the most sheltered places. Spring frosts of 27°F or lower were recorded after May 20 in 1958, 1959, 1961, and 1963 which could account for the restricted amount of flowering observed in those years.

Measurements of *C. candidum* and *C. Calceolus* var. *parviflorum* (author's collection No.'s 884 and 883) are similar to those published by Scoggan (1957) and Fernald (1950). The *C. candidum* plants were smaller than the *C. Calceolus* var. *parviflorum* specimens in all 6 of the measurements recorded (Table 1).

Indices for the naturally occurring *Cypripedia* indicated 8 plants resembled *C. candidum*, 8 resembled *C. Calceolus* var. *parviflorum* and 39 were intermediate between these two species and resembled *C. × Andrewsii* (Table 2). This classification was corroborated by the identifications reported by Boivin (1960). The index totals for the 8 *C. candidum* plants ranged from 10 to 14 and did not overlap with the 39 *C. × Andrewsii* specimens which ranged from 19 to 38. The 8 *C. Calceolus* var. *parviflorum* specimens index totals ranging from 30-47 formed a continuous series with *C. × Andrewsii*.

The parental species were not readily distinguishable on the basis of leaf number and width of lateral petals, hence, these two characteristics were of no value in indexing the specimens. Lip color of the hybrids ranged from white of the *C. candidum* parent to yellow of the *C. Calceolus* var. *parviflorum* parent with many creamy intermediate types. The seven other plant characteristics revealed a complete overlap of the parental species by the hybrids. The hybrids were readily separated from the *C. candidum* plants using either the indexing method of Stebbins (1957) or the standard taxonomic bases of specimen identification, but they were less readily distinguished from the *C. Calceolus* var.

parviflorum parent. This is in agreement with Stebbins (1957) that hybrids tend to resemble one parent more than another.

It is postulated that the hybrids are of relatively recent origin. The largest plants are the parental types and the hybrids are either single stemmed or small clumps. The slow growth and infrequency of bloom of *Cypripedia* indicates that the hybrid swarms could have developed since 1900. This would explain why J. H. Macoun and H. Criddle (Scoggan 1947), who observed the parental species in the Brandon — Aweme district did not report hybrid swarms of creamy colored *Cypripedium*.

These hybrid swarms probably developed as a result of a change in the environment in which the parent species grew. Hybrid swarms usually appear in a disturbed habitat but this is not possible with *Cypripedia* as they are never found in cultivated land, rarely in pastured areas, and are confined to areas that have been undisturbed. It is suggested

Table 2. Frequency of plant measurements of *C. candidum*, *C. Calceolus* var. *parviflorum* and *C. × Andrewsii* indexed according to Stebbins (1957).

Index No.	<i>C. candidum</i>			<i>C. × Andrewsii</i>					<i>C. Calceolus</i> var. <i>parviflorum</i>				
	1	2	3	1	2	3	4	5	1	2	3	4	5
Plant characteristic	frequency			frequency					frequency				
Plant height	5	3	0	5	8	12	9	5	0	0	1	3	4
Largest leaf-length	5	2	1	8	9	8	7	7	0	0	2	2	4
-width	7	0	1	6	8	7	13	5	0	0	0	3	5
No. of leaves ¹	3	5	0	7	27	5	—	—	0	6	2	—	—
Upper sepal-length	7	1	0	3	11	10	8	7	0	0	0	3	5
-width	8	0	0	6	6	14	10	3	0	0	0	2	6
Lateral petals-length	7	1	0	2	13	14	6	4	0	0	0	1	7
-width ²	3	5	0	5	17	16	1	—	2	0	2	4	—
Lip-length	8	0	0	3	12	7	8	9	0	0	0	3	5
-color	8	0	0	3	6	9	3	18	0	0	0	0	8
Range of totals	10 to 14			19 to 38					39 to 47				
Plant average	12.6			29.1					42.4				

¹Indexed on a 1 to 3 scale.

²Indexed on a 1 to 4 scale.

that although native *Andrena* bees were the probable natural pollinators, the introduction of the honeybee made the hybrid swarm possible. The introduction of honeybees in the early 1900's coincides with the estimated time when the hybrids originated and they could have been the insect vector which brought about the development of hybrids.

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